Question 1: **Regarding the pressurization events that occurred in (1) April/May 2011; (2) December 2011; and (3) March 2013, and which are discussed in the April 23, 2013 document entitled "Verification that FCC Catalysts Cause Pressurization Events at our HTS East Liverpool Facility" by Ralph Roper of the Heritage Research Group (hereinafter referred to as the "Roper report"), provide separate responses for each pressurization event:**

(a) Specify the date and time that each pressurization event occurred;

April/May 2011 Event: The secondary combustion chamber (SCC) at HTS East Liverpool facility (the "Facility") is operated under negative pressure. A pressure event is a sustained positive pressure within the SCC unit sufficient to trigger an automatic waste feed cutoff. As described in HTS' September 10, 2013 response to EPA's first request for information ("RFI 1"), HTS has determined that some, but not all, of these pressurization events are caused by the fall of energetic ash to the slag quench tank. These events are referred to as "energetic ash pressurization events."

During the April–May 2011 time period, a series of energetic ash pressurization events occurred at the Facility. However, only one of these events, which occurred at 10:40 pm on April 12, 2011, had sufficient energy to cause structural damage. Following this event, the system was down for repairs from April 12th to April 25th. During the weeks that followed the April 12, 2011 event, some additional energetic ash pressurization events occurred but these events were of lesser intensity and neither caused damage nor caused the system to be taken off-line. These subsequent events occurred on May 10th and May 11th at about 11:42 pm and 7:48 am, respectively.

Name	Start Time	End Time	Duration(hh:mm:ss)
SCC Pressure	4/12/2011 22:40	4/12/2011 22:40	0:00:04
SCC Pressure	4/12/2011 22:40	4/12/2011 22:41	0:01:01
SCC Pressure	4/12/2011 22:41	4/12/2011 22:42	0:00:26
SCC Pressure	5/10/2011 23:44	5/10/2011 23:44	0:00:05
SCC Pressure	5/10/2011 23:44	5/10/2011 23:44	0:00:12
SCC Pressure	5/10/2011 23:46	5/10/2011 23:47	0:01:02
SCC Pressure	5/11/2011 7:50	5/11/2011 7:50	0:00:21

December 2011 Event: Following several months during which no energetic ash pressurization events occurred, another energetic ash pressurization event occurred on December 17, 2011 at approximately 12:05 am. No structural damage occurred.

Name	Start Time	End Time	Duration(hh:mm:ss)
SCC Pressure	12/17/2011 0:05	12/17/2011 0:05	0:00:05
SCC Pressure	12/17/2011 0:05	12/17/2011 0:05	0:00:12

March 2013 Event: HTS experienced an energetic ash pressurization event on March 3, 2013 at about 5:44 am. No energetic ash pressurization events occurred for over one year leading up to this event. Like the December 17, 2011 event, no structural damage occurred.

Name	Start Time	End Time	Duration(hh:mm:ss)
SCC Pressure	3/3/2013 5:44	3/3/2013 5:45	0:00:36

This response was prepared by Vince Waggle and Ralph Roper.

(b) Describe each pressurization event. Include, but do not limit your response to the following: the sequence of events leading up to, during and after the event; the causes of the event; the type of waste that was processed or incinerated at the time of the event; the type of waste that was processed or incinerated during the 24-hour period prior to each event; the type and extent of damage to equipment; the effect on Facility air emissions (including whether emissions, gas or ash were allowed to escape from the process); and the Facility's response;

With the exception of the April 12, 2011 event, none of the events referenced in this Question 1 caused structural damage, none caused prolonged interruption of facility operations, and none resulted in emissions other than some smoke that entered the drum feed area in the room behind the front-wall zone of the kiln and water vapor from the slag quench tank. Further, the feed materials were the normal mix of solids, liquids, and drums for all three of the event periods. For a more detailed listing of the feed materials being processed during April/May 2011, December 2011, and March 2013 events, please refer to the total waste feed documents in Attachments 1, 2, and 3. Information on the Facility's response to each of these events is described immediately below, and in response to Question 1(d).

April/May 2011 Events:

During the April/May 2011 timeframe, an accumulation of slag referred to as a "slag doughnut" had developed several feet down from the front-wall and was believed to be somehow involved in the root cause of the April/May 2011 events. Various theories were being researched to explain whether this could be problematic. The slag doughnut problem persisted throughout the April/May 2011 period and, as discussed during a staff meeting conducted around May 17, 2011, it was noted that feeding the "Sunoco" sludge 96406-12 (from what is now the Philadelphia Energy Solutions facility) was a common denominator for the events and may have been responsible for the slag doughnut. It was extremely difficult to pinpoint the root cause of the energetic ash pressurization events at this time. Although HTS began considering the role of Sunoco 96406-12 in May of 2011, it had also incinerated large amounts of that waste stream in March 2011 without incident, suggesting that this waste was not a cause, or at least not the sole cause, of the energetic ash pressurization events. Nonetheless, and as described below, HTS stopped accepting Sunoco 96406-12 in September of 2011.

See Attachment 1 for the 4/16/2011 internal status report and the 6/3/2011 Safety Bulletin that describe the nature and extent of damages, responses initiated, several theories of the root cause, and waste feed data for the April/May 2011 events. Although gas, ash and steam escaped from the process through ruptured ductwork and seals, visual inspection of the perimeter confirmed that none of the dust and debris left the property during the April 2011 event and video of the event indicates that most of the expelled gas/steam was drawn back into the system as a negative pressure was quickly re-established.

For more detail on the HTS' investigation of the April/May 2011 event, please see the response to Question 1(d), below.

December 2011 Event

The December 17, 2011 event had a lot of energy but did not cause any structural physical damage. This energetic ash pressurization event was suspected to be caused by a single waste stream, Sunoco 96406-14. This waste stream was profiled to contain aluminum silicate catalyst which HTS theorized to be the main culprit in the doughnut formation inside the kiln. In order to control the doughnut formation, HTS limited the receipt of this waste stream. However, the investigation in the December 17, 2011 event showed that HTS had exceeded the receipt limit of this waste stream during the week of 12/12/11. After the December 17, 2011 event, HTS stopped accepting the Sunoco 96406-14 waste stream. Also, HTS Approval Chemists, who determine whether HTS will accept particular waste streams for incineration, were instructed not to approve bulk waste streams containing aluminum silicate catalysts from refineries.

See Attachment 2 for total waste feeds associated with the December 2011 Event.

March 2013 Event

In March of 2013, there was a significant energetic ash pressurization event in the SCC that caused no structural damage. Following this event, HTS revisited its theories regarding the energetic ash pressurization events. Following further investigation, HTS began to focus on certain types of bulk refinery wastes containing mainly zeolite type catalysts as the root cause of the problem. In an effort to better understand zeolite type catalysts, a review of literature on the composition of refinery zeolite catalysts, often referred to as FCC catalysts or aluminum silicates, was conducted. HTS learned that such catalysts typically contain low percentages of rare earth elements, especially lanthanum (La), which could serve as surrogates for detecting the presence of FCC catalysts in refinery wastes. The conclusion of this investigation, as stated in the April 23, 2013 report by Dr. Roper, was that the primary type of waste responsible for the pressurization events was refinery waste received in bulk containers (e.g., roll-off boxes) that contain significant amounts of FCC catalysts. Of particular concern were waste streams profiled as "clarified slurry oil solids" because the waste is directly from the catalyst recirculation process in the catalytic cracking unit. Waste streams identified as "heat exchanger bundle cleaning waste" or "bundle wastes" were also of particular concern because the solids could also be from the catalyst recirculation

system.

Once HTS had identified these waste streams of concern, guidance was issued to the approvals group to flag any waste streams currently approved with these constituents. HTS' protocols were changed to not allow shipments of these waste streams of concern. New waste streams of these types of materials were not approved for disposal through the incinerator. HTS then began analyzing all waste coming from refineries using Inductively Coupled Plasma (ICP) for silicon and aluminum in an attempt to screen for waste with high concentrations of zeolite catalysts. At around the same time, an effort was started to obtain an X-ray Fluorescence (XRF) instrument to better screen for these types of catalyst in waste.

Between March 2013 and July 13, 2013, three shipments of refinery waste were rejected or redirected to alternate facilities for suspected catalyst contamination. Despite significant efforts to screen for catalyst materials in refinery wastes, some concentrations of these catalysts were received in shipments of refinery wastes. HTS believes that these undetected catalysts concentrations were responsible for the energetic ash pressurization event of July 13, 2013.

See Attachment 3 for total waste feeds associated with the March 2013 Event.

This response was prepared by Ralph Roper, Steve Lorah and Carrie Beringer.

(c) List all the dates and times that HTS exceeded Operating Parameter Limits (OPL) and/or emission limits for the Facility on the dates of the events and afterwards until the hazardous waste residence times had transpired. For each day of exceedance, specify: the OPL and emission limit exceeded, the time period of the exceedance, and the highest values of the exceeded OPLs and emission limits;

HTS does not record instantaneous data. All data logged is logged as one minute averages. Although data is logged as one-minute averages, the OPL for SCC pressure is monitored and controlled instantaneously. Therefore, HTS cannot provide a high/low value for SCC pressure.

April/May 2011

Name	Start Time	End Time	Duration(hh:mm:ss)	High/Low Value	Applicable Emission Limit
SCC Pressure	4/12/2011 22:40	4/12/2011 22:40	0:00:04		Fug. Emi.
SCC Pressure	4/12/2011 22:40	4/12/2011 22:41	0:01:01		Fug. Emi.
SCC Pressure	4/12/2011 22:41	4/12/2011 22:42	0:00:26		Fug. Emi.
THC	4/12/2011 22:43	4/12/2011 23:43	0:60:00	19.0	CO/THC
SCC Temperature	4/12/2011 22:56	4/13/2011 06:59	8:03:43	729.9	DRE/Dioxin
Kiln Temperature	4/12/2011 22:59	4/13/2011 06:59	8:00:43	725.5	DRE/Dioxin
SDA ECIS Pressure	4/12/2011 23:22	4/13/2011 06:59	7:38:50	0	Dioxin/Hg
Process Gas Flow	4/12/2011 23:32	4/13/2011 00:17	0:45:58	70728	DRE/Dioxin/SVM/LVM/HCL/PM
RJ Blowdown Flow	4/13/2011 00:30	4/13/2011 02:19	1:49:00	0	Hg/Dioxin/SVM/LVM/HCL/PM
Scrubber ECIS Pressure	4/13/2011 03:04	4/13/2011 06:59	3:58:06	0	Dioxin/Hg
RJ Blowdown Flow	4/13/2011 04:02	4/13/2011 06:59	2:58:14	0	Hg/Dioxin/SVM/LVM/HCL/PM

SCC Pressure	5/10/2011 23:44	5/10/2011 23:44	0:00:05		Fug. Emi.
SCC Pressure	5/10/2011 23:44	5/10/2011 23:44	0:00:12		Fug. Emi.
SCC Pressure	5/10/2011 23:46	5/10/2011 23:47	0:01:02		Fug. Emi.
THC	5/10/2011 23:49	5/11/2011 00:48	0:59:00	12.6	CO/THC
SDA ECIS Pressure	5/11/2011 0:16	5/11/2011 1:51	1:35:59	0	Dioxin/Hg
Scrubber ECIS Pressure	5/11/2011 0:20	5/11/2011 1:51	1:31:57	0	Dioxin/Hg
SCC Pressure	5/11/2011 7:50	5/11/2011 7:50	0:00:21		Fug. Emi.

December 2011

Name	Start Time	End Time	Duration(hh:mm:ss)	High/Low Value	Applicable Emission Limit
SCC Pressure	12/17/2011 0:05	12/17/2011 0:05	0:00:05		Fug. Emi.
SCC Pressure	12/17/2011 0:05	12/17/2011 0:05	0:00:12		Fug. Emi.

March 2013

Name	Start Time	End Time	Duration(hh:mm:ss)	High/Low Value	Applicable Emission Limit
SCC Pressure	3/3/2013 5:44	3/3/2013 5:45	0:00:36		Fug. Emi.
SCC Temperature	3/3/2013 5:52	3/3/2013 6:47	0:55:48	1614	DRE/Dioxin

This response was prepared by Vince Waggle.

(d) Provide the results of all investigations into the cause of each event, the appropriate measures that could have been taken to prevent each event from occurring, and the steps HTS decided to take after each event to prevent additional occurrences. Provide copies of all your findings, conclusions and corrective measures taken or planned for the Facility by HTS, its agents, contractors, or others;

Since April of 2011, HTS has been working diligently to understand and correct the problem of energetic ash discharging into the slag quench tank, resulting in energetic ash pressurization events.

April/May 2011 Event: Baker Engineering and Risk Consultants, Inc. (BakerRisk) visited the plant immediately after the April 12, 2011 event to investigate the probable cause. The results are summarized in their May 31, 2011 report that was provided to US EPA by HTS in the attachment for Question 13e from RFI 1. In the aftermath of the April 12, 2011 event, BakerRisk and Heritage Research Group (HRG) worked with HTS to identify and evaluate the following theories regarding its cause:

1. Theory: A drum exploding inside the kiln. Detailed reviews of what was incinerated were generally made in the aftermath of an event. The rate and content of metal drums became a concern for the April 12, 2011 event, including drums that may have contained metallic aluminum residue. Corrective action was taken by slowing the drum feed rate, which temporarily appeared to have been successful.

2. Theory: A vapor cloud developed in the upper register of the SCC and combusted. This theory was proposed by the BakerRisk consultants. HTS studied the travel time and concentration pattern of the total hydrocarbon (THC) pulse that was recorded downstream at the stack after an event. Although the travel times were consistent with engineering calculations, it was impossible to conclude whether the THC pulse occurred right before or right after the energetic ash pressurization event. HTS believed that the THC pulse occurred right after the event (i.e., as a result of the event), as would be expected from a cloud of steam quenching the internals of the SCC.

3. Theory: Changes in the viscosity of the slag causing formations of slag "brows" at the exit of the kiln or "slag tsunamis," which then created an energetic steam release upon dropping into the quench pit. This slag brow problem was observed in May 2011 around the time that the May 10-11, 2011 events occurred. Given the variety of sludges, solids, and organic liquids incinerated, the combination of factors responsible for slag chemistry changes were numerous; therefore, HTS monitored brow conditions in the kiln.

4. Theory: An especially large "ash fall" triggered the energetic ash pressurization event. Minor bumps in pressure from ash falls were expected and understood well before energetic ash falls developed. What was not expected or understood was the intensity of events like the event on April 12, 2011. Accordingly, HTS and HRG began researching other phenomena that not only caused ash falls generally, but could also explain the energy intensity of that particular fall. One explanation for the energetic ash pressurization events was that the formation of a "slag doughnut" inside the kiln caused the flame from one of the liquid burner lances to fluidize solids in front of the doughnut and thereby entrain them in the flue gas. This in turn was causing rapid and heavy accumulations of ash on the sidewalls of the SCC, which could potentially lead to large ash falls and energetic ash pressurization events. Following the April 12, 2011 event, HTS implemented corrective action to prevent the development of the doughnut condition within the kiln. HTS utilized infrared camera outside the kiln for monitoring the kiln shell (the insulation from the doughnut causes the kiln shell temperature to be lower and thus observable by infrared camera). To prevent a doughnut, HTS continuously monitored the kiln shell temperature for signs of a buildup (e.g. doughnut). If build up was observed (as a change in kiln shell temperature), operators were instructed to reduce bulk solid feed and operate the natural gas burner to melt the doughnut. This theory—that a doughnut was a factor in the energetic ash pressurization events—appeared to be accurate until March and July of 2013, when energetic ash pressurization events occurred despite the absence of a slag doughnut in the kiln.

5. Theory: Steam explosions from accumulation of an explosive form of ash within the SCC caused the event. This was a new theory introduced around May 2011 based on ash explosions reported in the literature at coal fired power plants. Specifically, HTS and HRG considered work reported in a 1993 technical article that described a phenomenon whereby an energetic form of ash causes violent steam explosions in water quenched ash hoppers at coal fired power plants. See

Attachment 4 for the 1993 technical article. The report demonstrated that under certain time, temperature and composition conditions, ash can agglomerate on the walls above the ash quench pit and sinter in such a way that it becomes explosive when chunks drop down into the quench water below. The composition, sintering times, and temperatures most likely to result in energetic ash falls were similar to the conditions within the HTS SCC where ash falls occur. At the time HTS discovered this report, it was not understood that catalysts from refinery wastes could be related to these ash explosions, but research was ongoing.

After developing these theories, HTS and HRG continued to investigate and test the theories to identify a cause.

A comprehensive series of studies were performed using instrumentation and monitoring data including pressures, temperatures, O2, THC, water level, ash removal amounts, bulk feed rates, steel drum loading rates, etc. from the instrumentation system in an attempt to better understand where and how the event initiated and the sequence of events. The results basically indicated that all of the events in the April – May 2011 timeframe had similar data patterns, but that the one on April 12th, 2011 was especially energetic compared to the others. Detailed reviews of the specific drums fed to the unit prior to an event were also conducted to understand the waste being fed to the system at that time. *See* Attachment 5 for the drum feeds related to the April/May 2011 event.

Ultimately, the leading theories that emerged were theories 2, 4 and 5.

The first theory listed above was presented in the final Baker Risk report submitted in response to RFI 1 and was discussed in that response.

To further investigate the second theory listed above, slag doughnut material was collected from the interior of the kiln and submitted to the Heritage Research Lab for extensive analysis. These results are presented in the 4/29/2011 HRG document in Attachment 6, titled "2011-04-29 Analytical Results of 4-12 Slag Samples." The compositional data did not provide insight into why the doughnut may have formed other than potential overfeeding of the solids materials. As referenced above, HTS began to actively monitor and report kiln conditions with respect to doughnuts and slag buildup. Guidelines were developed to address feed and operating conditions during times when doughnuts were present as formation of a slag doughnut was thought to potentially be a leading indicator for energetic ash pressurization events. HRG and HTS continued to believe that the formation of a slag doughnut might be related to the energetic ash pressurization events due to the effects on fluidizing solids in the kiln. The fluidizing effect of the slag doughnut was observed visually while on-line.

The last theory listed above was proposed during a technical meeting in mid-May 2011. HTS and HRG recognized that Sunoco Waste No. 96406-12 was a common denominator in bulk feeds for both the April 2011 event and the events in May 2011. This particular waste contained zeolites, also known as aluminum silicates, and it was theorized that this component of this waste stream might be problematic. Large amounts of Sunoco 96406-12 were, however, incinerated in March 2011 without incident, confusing the issue and suggesting that this waste stream was not necessarily

a cause of the energetic ash pressurization event. Nonetheless, the receipt and processing of Sunoco 96406-12 was discontinued altogether in September of 2011.

In effort to correct potential root and contributing causes to the energetic ash pressurization events, HTS also undertook other measures to prevent further energetic ash pressurization events, should any of the theories prove to be accurate. Specifically, following April/May Events, HTS:

- Reduced the rate at which metal drums were fed to the incinerator;
- Incinerated metallic wastes in smaller containers;
- Stopped feeding certain material by itself;
- Stopped feeding reactive metals with the exception of aluminum;
- Actively monitored and reported kiln conditions with respect to brows, slag, etc.;
- Developed a procedure for operating and evaluating the SCC nozzles;
- Developed the procedure to address feed conditions during times when doughnuts are present or when brows become large and persistent;
- Established a solids feed limit;
- Returned SCC temperatures to higher pre-Comprehensive Performance Test (CPT) values; and
- Developed a procedure for monitoring and dealing with kiln slag conditions.

HTS pursued each of the above-mentioned corrective actions. Below are changes HTS made to the above corrective measures between May 2011 and December 2011:

Instead of developing a procedure to address feed conditions during times when doughnuts are present or when brows become large and persistent, HTS issued guidance and/or guidelines to actively manage doughnuts. See the example of guidance/guidelines issued in Attachment 7, Active Management Guidance.

Instead of developing a procedure for monitoring and dealing with kiln slag conditions, HTS issued guidance and/or guidelines to actively manage kiln slag.

Instead of developing a procedure for operating and evaluating the SCC nozzles, based on HTS' research, it was determined that SCC nozzles would not reduce the buildup of ash/slag in the SCC.

HTS continued to operate in compliance with MACT CPT solids feed limit instead of developing a 'new' solids feed limit.

For a time, HTS did return to higher SCC temperatures reflecting pre-CPT values, but has since restored SCC temperatures to current CPT values.

See Attachment 7 for HTS' Incident Investigation Reports and corrective action items for the April/May 2011 events.

December 17, 2011Event:

The December 17, 2011 event had a lot of energy but did not create any structural physical damage. This event was suspected to be caused by a single waste stream, Sunoco 96406-14. Based on the research and investigation into the April/May 2011 event, HTS discontinued receipt of the suspect waste stream, Sunoco 96406-12, in September 2011. However, in June of 2011, HTS approved a new waste stream for Sunoco, Sunoco 96406-14. This waste stream was profiled to contain aluminum silicate catalyst, also referred to as zeolites, which HTS theorized to be the main culprit in the doughnut formation inside the kiln. Therefore, in order to control the doughnut formation, HTS limited the amount of this waste stream it received.

Following the December 17, 2011 event, HTS conducted an investigation into its causes, which revealed that HTS had exceeded the receipt limit of Sunoco 96406-14 during the week of 12/12/11. *See* incident reports in Attachment 8, file names "121211 Incident Report 20111537" and "121711 Incident Report 20111538." In response to the event, HTS completely stopped accepting Sunoco 96406-14 after December 17, 2011. Also, HTS Approval Chemists, who determine whether HTS will accept particular waste streams for incineration, were instructed not to approve bulk waste streams containing aluminum silicate catalysts from refineries.

March 3, 2013 Event:

Since HTS experienced no energetic ash pressurization events for over one year, HTS believed that the corrective measures and actions implemented in response to the 2011 events were effective. After the March 3, 2013 pressurization event, HTS revisited its theories regarding the energetic ash pressurization events. Because the event took place in the absence of a slag doughnut, it was conclusively determined that the presence of a slag doughnut was not the sole cause of the energetic ash pressurization events. Following further investigation, HTS began to focus on certain types of bulk refinery wastes containing mainly zeolite type catalysts as the root cause of the problem. In an effort to better understand zeolite type catalysts, a review of literature on the composition of refinery zeolite catalysts, typically referred to as FCC catalysts or aluminum silicates, was conducted. HTS learned that such catalysts typically contain low percentages of rare earth elements, especially lanthanum, which could serve as surrogates for detecting the presence of FCC catalysts in refinery wastes. The conclusion of this investigation, as stated in the April 23, 2013 report by Dr. Roper, was that the primary type of waste responsible for the pressurization events was refinery wastes received in bulk containers (e.g., roll-off boxes) that contain significant amounts of FCC catalysts. Of particular concern were waste streams profiled as "clarified slurry oil solids" because the waste is directly from the catalyst recirculation process in the catalytic cracking unit. Waste streams identified as "heat exchanger bundle cleaning waste" or "bundle wastes" were also of particular concern because the solids could also be from the catalyst recirculation system.

Once HTS had identified these waste streams of concern, guidance was issued to the approvals group to flag any waste streams currently approved with these constituents.

See Attachment 9, "Guidance on Refinery Keywords" and "Guidance on Refinery Solids for Pits." Waste streams that were flagged using this guidance were no longer accepted for incineration. New waste streams of these types of materials were not approved for disposal through the incinerator. HTS then began analyzing all waste coming from refineries using ICP for silicon and aluminum in an attempt to screen for waste with high concentrations of zeolite catalysts. At around the same time, an effort was started to obtain an XRF instrument to better screen for these types of catalysts in waste.

During this time period, three shipments of refinery waste were rejected or redirected to alternate facilities for suspected catalyst contamination based on this testing procedure. Despite significant efforts to screen for these materials in refinery wastes, some concentrations of these catalysts were received in shipments of refinery wastes. HTS believes that these undetected catalyst concentrations were responsible for the excessive pressure events of July 13, 2013. For additional information on the testing employed by HTS, see the response to Question 5(a), below.

See Attachment 9 for HTS' Incident Investigation Report for the March 2013 event.

This response was prepared by Ralph Roper, Carrie Beringer, Stewart Fletcher, Scott Yocum, and Steve Lorah.

(e) Provide the container numbers, waste/chemical profile numbers, waste/chemical profile descriptions, and waste profile packets for the specific containers of waste that HTS believes were directly related to each pressurization event. Explain how these waste/chemical profiles and profile packets were derived (i.e., whether they were generated by HTS, the generator or both);

As described in HTS response to Question 1(d), above, HTS began investigating a number of theories regarding the causes of the energetic ash pressurization events following the April 2011 event and continuing to present. Until July 2013, HTS believed a combination of factors—including the incineration of FCC catalysts and the presence of slag doughnuts—contributed to the events. Since July 2013, HTS has established that the likely cause of the events is the presence of FCC catalysts, with lanthanum as an indicating component of the catalyst material. Applying this recent conclusion to the previous events, HTS has identified wastes that were related to each energetic ash pressurization event. Attachments 10, 11, and 12 contain the requested information for Question 1(e). These materials are summarized briefly below for each of the referenced events. For information on HTS' and generators' roles in the development of profile packets, see the responses to Question 1(h) and 6(a), below.

April/May 2011 Event:

The problematic waste HTS identified as a contributor to the April/May 2011 event was a clarified slurry oil tank sediment received from generator Philadelphia Energy Solutions, waste profile Sunoco 96406-12. HTS received approximately 100 bulk solid loads of this material. See Attachment 10 for container numbers, waste/chemical profile description and packet.

December 2011 Event:

The problematic waste HTS identified as a contributor to the December 2011 event was a petroleum refinery primary oil/water sludge (with catalyst fines) received from generator Philadelphia Energy Solutions, waste profile Sunoco 96406-14. HTS received approximately 9 bulk solid loads of this material in mid-December 2011. See Attachment 11 for container numbers, waste/chemical profile description and packet.

March 2013 Event:

The problematic wastes HTS identified as a contributor to the March 2013 event were received from generators Sunoco, Inc.; Toledo Refining Company; and Philadelphia Energy Solutions. The waste received from Sunoco, Inc., waste profile 128991-3, was clarified slurry oil storage tank bottoms. The waste received from Toledo Refining Company, waste profile 2484-102, was bundle solids. And the waste profile received from Philadelphia Energy Solutions, waste profile 96406-16, was petroleum refinery heat exchanger bundle. See Attachment 12 for container numbers, waste/chemical profile description and packet.

This response was prepared by Ralph Roper and Scott Yocum.

(f) Provide the dates when the waste containers identified in response to question 1(e), above, were received by the facility. Describe the handling process of the containers following receipt, as follows:

(i) Provide the method of storage, if applicable. If the waste was not stored, describe every step taken by HTS prior to the incineration of the waste;

The wastes identified in the response to Question 1(e) are bulk solid wastes and were transported in roll-off boxes (CMs) to the facility. After receipt, the material in the roll-off boxes was unloaded into HTS' bulk storage pits, where it was comingled with other bulk solid wastes prior to incineration. These roll-off boxes were not placed into storage after receipt at HTS. The waste in the containers was placed into storage in the bulk solid storage pits; however the containers themselves were not stored on site.

(ii) State whether the waste remained in its original container; was processed, repackaged, or removed from its original packaging by HTS; and/or was combined with other waste during storage or was separated; and

The waste remained in the original shipping container until it was approved to be placed into the bulk solid storage pits. The waste was removed from the original container by tilting the back end of the trailer and allowing the waste to gravity discharge into the bulk solid pit, where the waste was

combined with other bulk solids waste.

(iii) Describe the mode of transporting the waste to the feed for the incinerator, the method and rate of feed, and whether the waste containers were combusted with other waste streams, or were isolated.

The waste from the bulk solids pit, which contained waste identified in response to Question 1(e), was removed from the bulk solid pit using an overhead, clam-shell crane and track system. The waste was lifted from the bulk solid pit and transported to the feed chute of the incinerator using this crane.

The load delivered by the clam-shell crane was discharged from the clam-shell into the feed hopper. The feed hopper consists of two sets of doors to manage waste feeds into the incinerator. The first set of doors—outer doors—open to receive waste from the clam-shell. Once the clam-shell has discharged the waste, the outer doors close. Then the second set of doors—inner doors—opens to allow the waste to gravity feed into the incinerator.

There were numerous waste streams being incinerated at all times when the wastes listed in response to Question 1(e) were being fed to the incinerator.

See Attachment 13 for dates when the waste containers identified in response to Question 1(e), above, were received by the facility.

This response was prepared by Steve Lorah, Ralph Roper, Scott Yocum, and Carrie Beringer.

(g) Provide the dates and times when the waste containers identified in response to question 1(e), above, were introduced into the incinerator;

The dates of incineration for the wastes identified in Question 1(e) are listed in Attachment 13. The dates of incineration shown on the documents located in Attachment 13 are statistical calculations that document the date that the waste has been completely removed from the pit. The calculation is based on an even distribution of material in the pit and an average of all of the wastes that are comingled in the pit. When either the volume or the percentage of any individual load reaches a de minimis level, the inventory tracking system archives the record and shows that the load has been completely incinerated.

This response was prepared by Ralph Roper and Steve Lorah.

(h) Describe the screening process and criteria that HTS used for the waste containers identified in response to question 1(e), above, to determine that they should be

accepted into the facility and that they should be processed. Explain how this screening process and criteria were developed (i.e., the technical basis). Provide copies of and explain all protocols and criteria for accepting and/or rejecting refinery wastes that were utilized at the time of each of the pressurization events;

The screening process for bulk solids waste that was in place from prior to 2011 through March of 2013 was as follows. Prior to the waste streams being approved, a pre-acceptance sample was obtained from the generator and analyzed by the facility's on-site laboratory. This sample was analyzed according to the parameters described in the facility's Waste Analysis Plan. This analysis was compared to the waste profile, which was submitted by the waste generator, to determine if the waste sample matches the waste profile. The analytical report and the waste profile were then evaluated by the waste approvals group for consistency with waste acceptable for incineration as described by the facility's Waste Analysis Plan. Once the waste stream was approved, the waste shipment was scheduled for delivery through the Customer Service Department.

When the waste arrived at the facility, the manifest and shipping documentation were evaluated to determine if this was consistent with the approved waste stream. A label was printed and applied to the roll-off container. A sample of waste from the container was then obtained and analyzed by the facility's onsite laboratory for the parameters described in the facility's Waste Analysis Plan. This sample is called the fingerprint sample. This fingerprint analysis was then evaluated by a chemist for consistency with the waste stream profile. If the material was determined to be consistent with the waste stream profile, it was released to be unloaded into the bulk solids pit.

The screening criterion has evolved over the timeframe of the events described from April 2011 through March of 2013. Following the April 2011 incident, the screening process included all of the testing and requirements listed in the facility's Waste Analysis Plan. There was, at that time, no consensus on the specific cause of the energetic ash pressurization event, however it was suspected that a particular waste stream may have been involved with the event, so this waste stream was no longer received. Likewise, after the December 2011 event, the specific waste stream suspected to have contributed to the energetic ash pressurization event was no longer received.

Following the energetic ash pressurization event in March of 2013, it was believed that the ash fall was related to the presence of certain types of zeolite catalysts. HTS conducted research on zeolite catalysts and discovered that these types of catalysts contain aluminum and silicon in a certain ratio. Based on this research, HTS began analyzing all waste shipments from refineries for silicon and aluminum as indicators of zeolite. If the fingerprint samples showed elevated levels of these elements, in the correct ratios, the material was not accepted for incineration at the facility.

Following March 2013, HTS was using the ratio of aluminum and silicon to determine the acceptance of refinery waste. HTS had not yet developed a protocol to determine the

presence of FCC catalyst analytically or any threshold criteria for acceptance. As described in more detail in response to Question 6(g), below, HTS has continued to refine its screening process since the July 2013 event.

The technical basis for the screening process developed after March 2013 was based on the chemical makeup of common FCC catalysts used in oil refineries. Through research on these types of catalysts, it was determined that the base compounds were composed of silicon and aluminum at various ratios. HTS determined that the most common ratios for these components were from 0.5:1 to 2:1. So based on that, HTS determined that, if it had silicon and aluminum in these ratios in refinery wastes, there was the possibility of FCC catalyst being present. Later it was determined that there were certain rare earth elements present in some of these catalysts, most notably, lanthanum. HTS began testing for lanthanum on the ICP prior to the July 2013 incident, but the levels were below the detection limit of the instrument.

The ratio for the zeolite catalysts can vary widely, but the most common catalysts used in these types of refineries was determined to be within this range. This was based on review of several manufacturers' documents and industry research.

Waste may be rejected from HTS for various reasons. Some of these reasons include, but are not limited to, the following:

- A manifest discrepancy (or non-conformance) cannot be resolved to the generator's and/or the facility's satisfaction;
- The generator's/transporter's manifest is not in order;
- The bulk shipment is not compatible (fails the waste compatibility test) with wastes already in the receiving tank, and no other management method is available;
- There are major deviation(s) between pre-acceptance and fingerprint analyses;
- The shipment contains prohibited material as described in the Waste Analysis Plan or pursuant to HTS directives; or
- Radioactivity is greater than background.

If the HTS determines the bulk waste is not acceptable for incineration, the shipment will not be unloaded. The appropriate information will be recorded as a discrepancy, if applicable, on the manifest. The generator will be contacted to try to resolve the discrepancy. If resolution is not reached, the waste may be rejected from the facility in accordance with applicable regulations.

This response was prepared by Steve Lorah and Carrie Beringer.

(i) Explain why each specific container identified in response to item 1(e), above, was accepted and not rejected;

In each instance where a load was accepted and processed to the incinerator, the load met the criteria established for acceptance as described in Question 1(h). There were three instances where shipments of refinery waste that were received containing quantities of aluminum and silicon were rejected or redirected to alternate facilities. In all three of these instances, the ratio of silicon to aluminum fell within the 0.5:1 to 2:1

range. It was believed that this ratio indicated greater than 1% concentration of zeolite catalysts present. It was later determined that the methods for digesting these wastes failed to identify all of the aluminum and silicon in the waste because these elements are present in the oxide form. The oxide form of these compounds is not easily placed in solution by ICP digestion methods. See response to Question 5(a) for additional discussion of ICP digestions methods.

This response was prepared by Steve Lorah.

(j) Include copies of the results of all testing and analysis done on the specific waste containers at issue; and

Results of all testing and analysis done of the specific waste containers at issue are attached as Attachment 14 (testing related to April-May 2011 Event); Attachment 15 (testing related to December 2011 Event); and Attachment 16 (testing related to the March 2013 Event).

This response was prepared by Don Venturini.

(k) For the period January 1, 2011 through the present, provide the dates when HTS received and processed the same waste identified in response to question 1(e), above. Provide the waste profile numbers, waste profile descriptions, container numbers, and waste profile packets;

See Attachments 10, 11, and 12, for the waste profile numbers, waste profile descriptions, and waste profile packets. And see Attachment 17 for dates when HTS received and incinerated the waste identified in response to question 1(e).

This response was prepared by Ralph Roper.

<u>Question 2:</u> Regarding the pressurization event(s) that occurred during the April/May 2011 period that are discussed in the Roper report ("the April/May 2011 Incidents"), provide the following information for each separate event:

(a) Identify how and when HTS determined that Sunoco waste No. 96406-12 was the problematic material for the pressurization event. State which facility(ies) (location) generate(s) the Sunoco waste No. 96406-12;

Waste No. 96406-12, previously referred to as Sunoco No. 96406-12, came from the Philadelphia Energy Solutions, LLC (PES) refinery in Philadelphia, PA. The address listed on the uniform hazardous waste manifest is 3144 Passyunk Ave, Philadelphia, PA 19145. PES is a subsidiary of a much larger organization of which Sunoco is a part. The waste description for 96406-12 is “Clarified Slurry Oil Tank Sediment K170.” This waste stream was received in 2011 only, specifically from March 9 – September 28, 2011.

As described in response to Question 1(d), HTS identified a number of theories regarding the cause of the April 2011 event in April and May 2011. One of these theories was that,

because Sunoco Waste No. 96406-12 was a common denominator in both the April 2011 event and the events in May 2011, it could be a contributing factor in those events. However, HTS did not conclusively determine that waste streams with characteristics similar to Sunoco Waste No. 96406-12 caused the event during April and May of 2011. In fact, large quantities of Sunoco Waste No. 96406-12 were successfully incinerated in March 2011 without incident, suggesting it was not the root cause of the problem. *See* Table 2-1, below (showing the percentage of PES waste in the incinerator during each month from March – June 2011). Because the root cause of the events was unclear, HTS continued to investigate a number of theories between 2011 and 2013.

Table 2-1
Monthly amounts (lbs) of Waste No. 96406-12 Received vs. Other Refinery Wastes

	96406-12		
Month	PES	Other	% PES
Mar-11	1,057,030	303,420	78%
Apr-11	907,220	162,784	85%
May-11	1,161,280	156,420	88%
Jun-11	523,100	448,920	54%

It was not until April 2013 that conclusive evidence was developed and presented in the "Roper report" that the Sunoco waste No. 96406-12 and other similar wastes were the base cause of the energetic ash pressurization events. During the course of developing the April 2013 "Roper report", a literature review was conducted on how FCC catalysts were made including the rare-earth elements added to them in low but measurable concentrations. This spawned the idea of reviewing previous XRF analytical data on the slag doughnut material removed from the kiln from the April 12, 2011 event. Using lanthanum and other rare-earth elements as surrogates for the presence of FCC catalysts, the results of the XRF showed that the "slag doughnut" material from the April 12, 2011 event was indeed comprised of FCC catalyst and not some other residue for other waste streams. Although the slag doughnut was not the sole cause of the April 2011 event, the composition of the slag doughnut further indicated the FCC refinery catalysts were a key problem.

This response was prepared by Ralph Roper.

(b) Explain how and when HTS determined that the Sunoco waste No. 96406-12 "...seemed to be causing the build-up of slag 'doughnuts' in the kiln," as stated in the Roper report; and

See Response to Question 2(a), above. While a slag doughnut was present during the April 12, 2011 event and the May 10-11, 2011 period and it was theorized by HTS that it was caused by feeding waste stream Sunoco 96406-12, HTS did not confirm that Sunoco 96406-12 was contributing to the presence of the slag doughnut and the energetic ash pressurization events until April 2013. Prior to that time, HTS was aware that Sunoco Waste No. 96406-12 was a common denominator in the April and May 2011 events, but continued to believe that other theories more accurately explained the energetic ash

pressurization events, especially in light of the fact that Sunoco 96406-12 was incinerated in large quantities in March 2011 without incident.

This response was prepared by Ralph Roper.

(c) Explain in detail why at least five pressurization events occurred before HTS stopped processing the Sunoco material.

The response to this question was presented in the response to Question 1(b) and 1(d), above.

This response was prepared by Ralph Roper.

Question 3: Regarding the pressurization event(s) that occurred during or around the week of December 12, 2011, and that are discussed in the Roper report, provide the following information:

(a) Explain how HTS determined that Sunoco waste No. 96406-14 was the problematic material. State which facility(ies) (location) generate(s) the Sunoco waste No. 9640614; and

See Response to Questions 2(a), 1(b), and 1(d).

Shortly after the December 2011 event, HTS staff members expressed their opinion that the energetic ash pressurization event was caused by zeolites from refinery catalysts. After reviewing the burn record, HTS discovered about half of the refinery wastes received during the few days before the event were Sunoco waste 96406-14. As shown in Table 3-1, the other half was from four other refineries.

Table 3-1
Refinery Wastes Received between 12/12/2011 and 12/17/2011

Refinery	WS No.	lbs
Phil Energy Sol	96406-14	218,980
Paulsboro	92743-22	129,440
BP-Husky	119062-5	45,100
BP-Whiting	124095-1	29,880
Toledo Refinery	2484-102	23,240

The waste description for Waste No. 96406-14 was typical of a traditional refinery waste, except that it included "w/ catalyst fines." Because of the presence of the word "catalysts," HTS presumed that Sunoco Waste No. 96406-14 was the cause of the problem. No loads of this waste stream were received after December 14, 2011. For additional information, see HTS responses to Questions 1(b) and 1(d), above.

This response was prepared by Ralph Roper.

(b) Explain why HTS did not reject Sunoco waste No. 96406-14 prior to or at the time of

the December 12, 2011 Incident even though it contained FCC catalysts.

See responses to Question 1(b), 1(d) and 2(a), above.

This response was prepared by Steve Lorah, Scott Yocum, Ralph Roper, and Carrie Beringer.

Question 4: **Regarding the pressurization event(s) that occurred during or around March 3, 2013 ("the March 3, 2013 Incident"), that are discussed in the Roper report, answer the following questions:**

(a) Explain how and when HTS determined that the problematic material came from the Sunoco Marcus Hook plant and was a listed K170 waste; and

See response to Question 4(b) below.

(b) Explain why during the acceptance/rejection evaluation process, HTS was unaware and/or did not flag as a concern, the presence of alumina catalyst in the K170 waste;

There were no significant energetic ash pressurization events for over one year prior to the March 2013 event. Accordingly, HTS believed its preventative/corrective actions stated previously in this document, which HTS described in response to Question 1, were effective at preventing pressurization events. The incident that occurred on March 3, 2013, though not powerful enough to cause major damage, triggered a renewed effort to identify, monitor, and control the specific component of some refinery wastes responsible for the underlying cause of the problem.

About a third of the refinery wastes received during the days leading up to the March 2013 event came from the Sunoco plant in Marcus Hook, PA. Most of the remainder came from the BP-Whiting facility. HTS has a long history of successfully incinerating the BP-Whiting material, whereas the Sunoco Marcus Hook waste stream was relatively new to the system. Several loads were incinerated toward the end of December 2012 without incident. Additional loads came in late February 2013.

The Sunoco Marcus Hook waste stream number was 128991-3 and the description of the waste was “Clarified Slurry Oil Storage Tank Bottom.” Although a listed K170 waste, it was not known by HTS at the time that the clarified slurry oil tank in refineries is an integral part of the FCC catalyst recirculation/regeneration system and the sediment in the tank would likely be mainly FCC catalyst. Moreover, HTS had avoided energetic ash pressurization events by excluding two waste streams—Sunoco 96406-12 and Sunoco 96406-14—and thus reasonably assumed that its then-effective control measures were successful. Following the March 2013 event, it was clear that a more definitive analysis was needed to determine the wastes, in addition to Sunoco 96406-12 and Sunoco 96406-14, that could result in energetic ash pressurization events.

This led to the development of the HRG report prepared by Dr. Roper and submitted for internal review on April 23, 2013. In accordance with the report, HTS immediately began testing every bulk delivery from refineries for aluminum or silicon in an attempt to screen out significant concentrations of these zeolite catalysts. It also began the process

to obtain an XRF instrument to further refine its sampling procedures.

This response was prepared by Ralph Roper.

Question 5: **In its September 11, 2013 response to EPA's Request for Information, HIS stated that: "[f]ollowing the March 2013 incident, HTS began testing every bulk delivery from refineries for aluminum or silicon in an attempt to screen out significant concentrations of these zeolite catalysts. This testing was done by Inductively Coupled Plasma (ICP) methods following a nitric acid digestion under SW846 3050 and 3051. Using this approach, HTS rejected 3 bulk loads in a period of 4 months. HTS also recognized that these methods had their limitations, and began the process to obtain an X-ray Fluorescence (XRF) instrument...HTS was in the process of obtaining the XRF when the incident on July 13, 2013 occurred." Please provide the following information:**

(a) **Explain the limitations of the ICP testing/sampling methods in comparison to an XRF;**

The ICP test method is used to determine trace elements in solution. The instrument measures characteristic emission spectra by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and the intensities of the emission lines are monitored by a photosensitive detector.

Prior to analysis, ICP samples must be digested to get the elements of interest in solution. This preparation of the samples results in some limitations in the ICP method. Specifically, before obtaining an XRF, HTS used SW 846 method 3051 to prepare samples for metal analysis and SW 846 method 3052 to prepare samples for silica analysis on the ICP.

Method 3051 is designed to mimic extraction using conventional heating with Nitric acid using microwave digestion. This method is intended to extract metals from sediments, sludges, soils and oils for the following elements: Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Vanadium and Zinc. It is intended to provide a rapid multi-element acid extraction or dissolution prior to analysis so that decisions can be made about materials quickly. Many types of samples will be dissolved by this method. A few refractory sample matrix compounds, such as quartz, silicates, titanium dioxide, alumina, and other oxides may not be dissolved and in some cases may sequester target analyte elements. These bound elements are considered non-mobile in the environment and are excluded from most aqueous transport mechanisms of pollution.

Method 3052 is applicable to the microwave assisted acid digestion of siliceous

matrices, and organic matrices and other complex matrices. Most samples will be totally dissolved by this method with judicious choice of the acid combinations. A few refractory sample matrix compounds, such as TiO2, alumina, and other oxides may not be totally dissolved and in some cases may sequester target analyte elements.

By contrast, XRF is a non-destructive analytical technique and each sample requires minimal preparation before it can be analyzed. HTS prepares each sample by ashing to drive off any organic material in the sample. X-rays are applied equally to the entire sample causing all of the elements present to fluoresce.

In principle, when a sample is exposed to x-rays, its component atoms are ionized. Ionization, which consists of the ejection of one or more electrons from the atom, occurs when the atom is exposed to radiation with energy greater than its ionization potential. X-rays are energetic enough to expel tightly held electrons from the inner orbitals of the atom. The removal of the electron in this way makes the electronic structure of the atom unstable, and electrons in higher orbitals "fall" into the lower orbital to fill the hole left behind. When the electron falls, energy is released in the form of a photon (the energy of which is equal to the energy difference of the two orbitals involved) and the material emits radiation, which is characteristic of the atoms present.

The ICP testing method requires the sample to be placed into solution. Some of the materials that HTS was analyzing for are very difficult to place into solution, namely Aluminum Oxide (alumina) and Silicon Dioxide (silica). These are the primary components of the zeolites that HTS was attempting to quantify by this method. The digestion methods used for these wastes were not completely effective in dissolving the alumina and the silica and as such gave relatively low numbers for the results.

Also, both alumina and silica are very common components in other waste materials. These compounds show up in many materials that do not have zeolites present, and can give false positives.

XRF is a non-destructive test and does not rely on the solubility of these components to quantify the element in the sample.

This response was prepared by Don Venturini and Steve Lorah.

(b) Explain when and how H TS determined that ICP "had limitations" for "completely detecting the elements of concern." Provide all supporting documentation;

In comparing the results of the ICP testing that had been done at the facility's on-site laboratory to the XRF testing that had been done by the HRG laboratory, it became clear that some elements were understated in the ICP results. HTS began to research the methods for the digestion process in more detail during the spring of 2013. It

determined that XRF was a more appropriate method for detecting zeolites and their components because, as described in response to Question 5(a), above, XRF does not rely on solubility to quantify the elements in the sample.

This response was prepared by Don Venturini and Steve Lorah.

(c) What steps had HTS taken to obtain an XRF prior to July 13, 2013 and when did HTS take each step? Provide all written supporting documentation; and

Once it was determined that an XRF might be a useful tool for screening samples at HTS, HTS took the following steps to obtain an XRF:

5-9-13	The Bruker S2 Ranger XRF was taken from storage and set up in HRG's lab.
5-13-13	The S2 Ranger was sent to Bruker for service and during that time a new detector was installed.
6-6-13	The S2 Ranger arrived back at HRG and work began to develop the method and prepare it for shipment to HTS.
7-22-13	The S2 Ranger was delivered to HTS and two HRG employees conducted a training for HTS employees on sample preparation and use of the instrument. When the July ash release occurred the XRF had not yet been delivered to HTS. Samples from the release were rushed to HRG for analysis on the XRF instrument.
9/2013	HTS discovered three refinery shipments that were contaminated with FCC catalyst.
9-18-13	Four HTS laboratory employees attended an XRF seminar to learn more about XRF analysis.
12-10-13 thru 12-14-13	Bruker came to HTS for XRF training. The training focused on method development to help HTS maximize the capabilities of the S2 Ranger.
12-16-13 thru 1-31-14	HTS and HRG performed a series of inter-laboratory comparison tests to determine how well the S2 Ranger was able to see lanthanum at the appropriate detection limit.
2-1-14	HTS and HRG determined that the S2 Ranger did not have the sensitivity needed to see lanthanum at the appropriate detection level.
2-2-14	The decision was made that HRG would analyze all refinery solids before they are delivered to HTS for disposal.
3-31-14	HTS placed an order for a more sensitive XRF instrument.
5-8-14	The more sensitive XRF instrument arrived at HTS.

See Attachment 18 for timeline support documentation.

This response was prepared by Don Venturini and Erin Clark.

(d) Explain how HTS's conclusion that the March 2013 incident was caused by the processing of waste containing synthetic zeolites (a crystalline form of aluminum silicates) is different than HTS's conclusion in or around April 2011 that the April 2011 incident was caused by refinery wastes that were high in aluminum silicates. See your September 11, 2013 response to Question 6 of EPA's previous Request for Information.

The investigative process that HTS has followed to determine the cause of the extremely complicated phenomenon referred to as energetic ash pressurization events has covered a more than two year span of time. Indeed, HTS continues to refine analysis and study regarding this issue. During the time between the April 2011 event and the July 2013 event, HTS had engaged consultants and experts in an effort to develop definitive

conclusions. Many theories were proposed. Different testing methods were employed. Several actions were taken. All of these efforts were intended to prevent recurrence.

As the investigation progressed, some theories were given more validity than others. However, at the point in time of the April 2011 event, HTS did not fully understand the type of aluminum silicates that are now suspected to cause the energetic ash pressurization events. In addition to other theories, HTS developed two areas of study relative to aluminum silicates. HTS reviewed an article on power plants that were experiencing a similar phenomenon. It showed that the ash was high in aluminum silicates. Literature shows that aluminum silicates, minerals very commonly found in nature, can have a crystalline structure that contains a high surface area. Synthetic aluminum silicates are engineered to have extremely high surface area (as discussed below). Secondly, HTS knew from observation that refinery solids wastestreams were a significant component of the feed, as well as a relatively new component of the feed. This is why the individual wastestreams that comprised the general category of refinery solids wastestreams were analyzed to see if any correlation between this feed component and the events could be discovered. As a result, action was taken to stop receiving one refinery wastestream that tested high in aluminum silicates after the April 2011 event (see Question 1 response for more detail).

As the investigation continued and HTS sought out more consultants and experts, HTS learned that some refinery catalysts are made of synthetic aluminum silicates. These synthetic aluminum silicates are orders of magnitude higher in surface area than naturally occurring mineral aluminum silicates. Thus, a relatively small amount of these types of aluminum silicates could create an energetic ash pressurization event. This piece of information gave more validity to the theory of refinery solids being a potential source of the energetic ash pressurization events because aluminum silicates are so common that the presence of that material in the incineration system has been a fairly common feed since the incinerator started operation over 20 years ago, yet energetic ash pressurization events did not occur until recently. HTS' study of the use of synthetic aluminum silicates as catalyst in the refining industry was just being developed and understood in the spring of 2013 as described in the April 23, 2013 document referred to as the "Roper Report". To further complicate matters, the difficulties in testing for the presence of this synthetic material is described in response to Question 5(a), above. This is why in April 2011, HTS was investigating refinery wastes high in aluminum silicates more generally, but in April 2013 was pursuing the more evolved theory that refinery wastes containing **synthetic** aluminum silicates (commonly referred to as FCC catalysts) were the most likely cause of the energetic ash pressurization events.

This response was prepared by Winde Hamrick.

Question 6: Regarding the pressurization event(s) that occurred July 13, 2013 (the "July 2013 Incident"), answer the following questions:

(a) Provide the container numbers, waste/chemical profiles, waste chemical descriptions, and waste profile packets for the specific containers of waste that HTS believes caused or were directly related to the July 13, 2013 pressurization event. Explain how these waste/chemical profiles were derived, and whether they were generated by HTS, the generator or both;

See Attachment 19 for container numbers, waste/chemical profile, waste chemical description, and waste profile packet.

For the waste stream identified in Attachment 19, a profile was provided by the generator with a sample for approval. The sample was analyzed by the facility's internal laboratory, and the analysis and the profile were then reviewed and approved by HTS personnel. If there were questions in terms of consistency with the profile, HTS requested that the generator resolve these issues prior to the profile being approved.

This response was prepared by Steve Lorah and Scott Yocum.

(b) Provide the dates when the waste containers identified in response to item 6(a) above, were received by the Facility. Describe the handling process of the containers following receipt, as follows:

See Attachment 19 for dates when the waste containers were received by the Facility.

(i) **Provide the method of storage, if applicable. If the waste was not stored, describe every step taken by HTS prior to the incineration of the waste;**

The wastes identified in the response to Question 6(a) are bulk solid wastes and were transported in roll-off boxes (CMs) to the facility. After receipt, the material in the roll-off boxes was unloaded into HTS' bulk storage pits, where it was comingled with other bulk solid wastes prior to incineration. These roll-off boxes were not placed into storage after receipt at HTS. The waste in the containers was placed into storage in the bulk solid storage pits; however the containers themselves were not stored on site.

This response was prepared by Steve Lorah.

(ii) State whether the waste remained in its original container; was processed, repackaged, or removed from its original packaging by HTS; and/or was combined with other waste during storage or was separated; and

See the response to Question 1(f).

This response was prepared by Steve Lorah.

(iii) Describe the mode of transporting the waste to the feed for the incinerator, the method and rate of feed, and whether the waste containers were combusted with other waste streams, or were isolated.

See the response to Question 1(f).

This response was prepared by Steve Lorah.

(c) Specify the dates and times that the waste containers identified in response to item 6(a), above, were introduced into the incinerator;

See Attachment 19, listing the dates and times that the waste containers identified in response to Question 6(a) were introduced to the incinerator.

This response was prepared by Ralph Roper.

(d) Describe the screening process and criteria that HTS used for these specific waste containers to determine that they should be accepted into the facility and then processed. Explain how this screening process and criteria were developed (i.e., the technical basis). Provide copies of and explain all protocols and criteria for accepting/rejecting refinery wastes that were utilized at the time of the July 2013 Incident.

See the response to Question 1(h).

This response was prepared by Steve Lorah.

(e) Explain in detail why each specific container that was a cause of or aggravating factor in the July 2013 Incident was accepted for incineration and was not rejected;

Each container that was accepted met the criteria that had been established for acceptance into the facility. This is further explained in the response to Question 1(h) and 5(a).

This response was prepared by Steve Lorah.

(f) Include copies of the results of all testing and analysis done on the specific waste containers at issue that were identified in response to item 6(a), above;

See Attachment 20 for results of testing and analysis.

This response was prepared by Don Venturini.

(g) Explain any additional investigation or follow up that HTS has conducted since the July 2013 Incident that is not discussed in HTS' response to EPA's Request for Information and report the results. Include a discussion regarding the investigatory shutdown that was proposed to occur in or around September 2013 to inspect the SCC; and

Since July 2013, HTS has worked diligently to investigate and correct the conditions that caused the July 2013 event.

Shutdown Inspection – September 2013.

To further investigate the cause of the July 2013 incident, HTS shutdown the incinerator for inspection and testing on September 16, 2013. Between the July maintenance shutdown and September 16, 2013, 23 bulk loads and 45 drums of refinery waste were passed through the unit.

Samples of solids build-up from within the SCC were obtained and analyzed in order to determine whether the restricted feeds of refinery streams could be seen in the solids. The solids were analyzed using X-ray diffraction (XRD) analysis by an independent lab and identified as silicon dioxide (81.9%), calcium silicate (pseudowollastonite – 9.6%), diopside (7.4%) and Ca3Al2O6 (1%). These types of compounds are common elements found in other wastes incinerated and the environment and have high melting points. No materials of concern were identified as a result of this shutdown, inspection and sampling.

After the September 16, 2013 inspection, HTS continued lanthanum monitoring for all loads being shipped from the refineries. This monitoring captured an increase in levels of lanthanum that was traced back to a process-related change at a specific generator. Refinery shipments were halted until the levels of lanthanum in these materials returned to background levels and a background threshold could be determined. This confirmed that the administrative controls HTS implemented are effective at detecting lanthanum.

Energetic Ash Symposium – December 2013 – and Resulting Actions

To further investigate the energetic ash pressurization events, HTS assembled a group of experts from various consulting and engineering firms and hosted a symposium to discuss these events. FCC and refinery experts also were invited, and representatives from Heritage Environmental Services (HES), HRG and HTS also participated.

Various action items were identified and pursued related to the meeting. A consulting firm was retained to research and identify technologies that could be applied for detection and removal of build-up in the SCC on-line. The consulting firm identified Light Detection And Ranging (LIDAR) and camera technology as two options that warranted further review. HTS then contacted SANE and Leicos Technologies regarding use of their LIDAR equipment while on-line. There were no product offerings identified, however, that could function under normal operating conditions of the SCC. SANE Technologies products have been used by the facility in the past for offline scanning of the unit, but could not feasibly be applied during operation.

Another company, FLIR Technologies, provided a high temperature camera for trial through view ports. HTS is analyzing the images captured during this trial to determine whether the camera can distinguish between sintering powder build-up and glassy slag build-up, or a compositional mixture of the two.

No good option was identified for on-line removal of the slag or ash. While some experts suggested a Cardox system, this system would require large numbers of penetrations through the SCC wall and refractory brick and its effectiveness for actually cleaning out the buildup of problematic material is questionable. A soot blower device was also suggested. These devices have been used with good success in boilers to remove ash, however there were two concerns with this option. First, the positive pressurization of the SCC during cleaning would impact OPLs. Second, its effectiveness on slagged materials or slagged mixtures is uncertain.

During the Symposium, it was confirmed that lanthanum is generally a good marker compound indicating the presence of FCC catalyst materials. Accordingly, HTS continued using lanthanum for its testing, as described above and below.

Slag Quench Re-Design – January 2014

In January 2014, HTS engaged a consulting engineering firm to work with HTS personnel to investigate conversion of the slag quench tank design to a semi-dry quench design. The project team developed draft Process Flow Diagrams (PFD), budgetary costs and made preliminary contacts with regulatory agencies to discuss potential permitting changes. Ultimately, it was determined that the total water in the system could not be reduced enough to sufficiently eliminate the generation of steam pressure and prevent over-pressurization, given the sudden release of catalytic material. There were other operational concerns expressed with the practicality of the design as well. These included slag buildup on the walls, installation of an air-lock valve on the conveyor, conveyor lubrication and effects of gas condensation in the slag quench tank space. The decision was therefore made to stop pursuing this solution.

Emergency Safety Vent

HTS is working on an engineering review of the secondary combustion unit to incorporate a safety relief device into this process unit. This work includes evaluating a location for safe relief to prevent potential exposure of personnel should an excess pressure event occur and relative sizing and relief strategies based on the event experienced in July.

Establish Pre-Shipment Testing of Refinery Waste with La Screen

Based on statistical review of data by HRG, HTS determined that a concentration of 0.124% by weight of lanthanum was generally representative of background levels of FCC materials that had been successfully processed through the unit without incident. This threshold was established for screening purposes in February of 2014. The screening threshold testing is based on an ashed sample of the refinery solids. The sample is first placed in a muffle furnace to drive off any water and organic materials, then the dry sample is analyzed using XRF equipment to check weight percent lanthanum. This concentration threshold is significantly lower than concentrations of lanthanum seen in spent FCC catalyst samples from various refineries, which vary from 0.892% La to 4.53% La.

After developing this screening level, HTS determined that its XRF instrument was not sufficient to effectively identify lanthanum at these low concentrations. The instrument in

use at the HRG labs in Indianapolis, however, was capable of accurately determining these concentrations. Accordingly, HTS changed its procedures and began shipping samples to HRG for analysis prior to waste acceptance. HTS also began investigating the possibility of purchasing an XRF instrument sufficient to screen samples for lanthanum. HTS ultimately decided to purchase such an XRF and, as described in response to Question 5(c), a new, more sensitive XRF arrived at the facility on May 8, 2014.

Refinery Feed Trial – February 2014 with Shutdown Inspection

In order to test the concentration-based acceptance threshold, a refinery feed trial was completed in February. A feed schedule of boxes of refinery generated wastes from two large volume refinery sources was assembled. Over the course of a week, 17 boxes from these sources that met the lanthanum screening threshold were fed to the unit. The slag and ash was monitored for solids generation rates and regular samples were taken from the slag trailer and ash system to look for lanthanum materials.

There were no pressure events in the unit associated with this trial. Lanthanum was tracked and an estimated 86% of the input lanthanum materials were accounted for indicating that lanthanum was not building up in the SCC. In addition, HTS conducted a visual inspection after the refinery feed trial to verify there was no significant buildup of loose ash in the SCC. HRG estimated that there was full recovery of the input quantity of lanthanum.

Resumption of Feeding of Limited Amounts of Pre-Screened Refinery Waste.

Based on these results, HTS decided that the lanthanum screening threshold, in combination with knowledge of a specific refinery's spent FCC catalyst, was a good indication of whether the material could process through the unit without issue. Loads of waste that meet this screening criteria have been processed through the unit without incident since February.

Introduced Surface Area Analyzer

Another property of FCC catalyst that was observed with each sample of spent material was high surface area per gram. Spent FCC catalyst was observed to have surface areas in excess of 50m2/gram. An effort has been made to correlate lanthanum concentration with surface area. To date, this has not been successful. While lanthanum concentration is believed to be a reliable indicator of FCC catalyst content, surface area does not appear to be an effective indicator. However, HTS has leased a surface analyzer for a period of time and is continuing to collect data in order to determine if any correlation exists. If, after sufficient data is collected, no correlation is found, the surface analyzer will be returned.

This response was prepared by Stewart Fletcher.

(h) For the period January 1, 2011 through the present, provide the dates when the same waste identified in response to item 6(a), above, was received and processed by HTS. Include the container numbers, waste/chemical profile numbers, waste/chemical profile descriptions, and waste profile packets.

See Attachment 19 for the waste profile number, waste profile description, and waste profile packet. And see Attachment 21 for dates when HTS received and incinerated the waste identified in response to item 6(a).

This response was prepared by Scott Yocum.

Question 7: For the period January 1, 2011 through the present, has the HTS Facility experienced any other "energetic ash" clinker falls other than the April/May 2011 Incidents, December 12, 2011 Incident, March 3, 2013 Incident, and the July 2013 Incident? If so, provide the information sought in question 1, above, separately for each incident.

HTS believes that the events specified are the only clinker fall events resulting from "energetic ash" to have occurred at the facility between January 1, 2011 to the present, with three exceptions. On January 16, 2011, June 9, 2011, and January 31, 2012, HTS experienced ash falls it believes were caused by energetic ash pressurization events.

January 16, 2011

The January 16, 2011 ash fall event caused no structural damage or extended interruption to operations. At the time, the plant did not note this as a more energetic event than other clinker falls they had experienced in the past. In fact, HTS did not realize this was an energetic ash pressurization event until it began a renewed investigation following the July 2013 event. As a result, the event was not pursued as being anything beyond a clinker SCC Pressure malfunction. The unit was reset and resumed operations after this cutoff once a THC exceedance had cleared the system and permissives were achieved.

June 9, 2011

The June 9, 2011 event also caused no structural damage, no prolonged interruption of facility operations, and no resulting emissions other than some smoke that entered the drum feed area in the room behind the front-wall zone of the kiln and water vapor from the slag quench tank. Further, the feed materials were the normal mix of solid, liquid, and drums.

January 31, 2012

The January 31, 2012 event also caused no structural damage, no prolonged interruption of facility operations, and no resulting emissions other than some smoke that entered the drum feed area in the room behind the front-wall zone of the kiln and water vapor from the slag quench tank. Further, the feed materials (solids, liquids, and drums) were the normal mix of solid, liquid, and drums. *See* Attachment 22 for listing of feed materials for the January 16, 2011, June 9, 2011, and January 31, 2012 events. At the time, the plant did not note this as a more energetic event than other clinker falls they had experienced in the past. In fact, HTS did not realize this was an energetic ash pressurization event until it began a renewed

investigation following the July 2013 event.

The date and time of the January 16, 2011, June 9, 2011, and January 31, 2012 events are as follows:

Name	Start Time	End Time	Duration(hh:mm:ss)
SCC Pressure	1/16/2011 7:53	1/16/2011 7:54	0:00:43
SCC Pressure	1/16/2011 7:55	1/16/2011 7:55	0:00:32
SCC Pressure	1/16/2011 7:56	1/16/2011 7:56	0:00:03
SCC Pressure	1/16/2011 7:56	1/16/2011 7:56	0:00:10
SCC Pressure	1/16/2011 7:57	1/16/2011 7:57	0:00:17
SCC Pressure	1/16/2011 7:57	1/16/2011 7:57	0:00:03
SCC Pressure	1/16/2011 7:58	1/16/2011 7:58	0:00:14
SCC Pressure	1/16/2011 7:58	1/16/2011 7:58	0:00:03
SCC Pressure	1/16/2011 8:01	1/16/2011 8:01	0:00:05
SCC Pressure	1/16/2011 8:01	1/16/2011 8:01	0:00:03
SCC Pressure	6/9/2011 7:30	6/9/2011 7:30	0:00:05
SCC Pressure	6/9/2011 7:30	6/9/2011 7:30	0:00:03
SCC Pressure	1/31/2012 3:04	1/31/2012 3:04	0:00:05
SCC Pressure	1/31/2012 3:04	1/31/2012 3:04	0:00:12

The dominant bulk waste being incinerated from mid-March 2011 to July 2011 was waste No. 96406-12 from the Philadelphia Energy Solutions refinery, referred to as Sunoco 96406-12. It was believed at the time that the slag doughnut was involved in the root cause of the energetic ash pressurization events and/or that there was something unique about the Sunoco 96406-12 wastestream. The specific cause of the June 9, 2011 event was not identified in 2011, however HTS stopped accepting Sunoco 96406-12 in September 2011.

Below are dates and times that HTS exceeded Operating Parameter Limits (OPL) and/or emission limits for the facility on January 16, 2011, June 9, 2011 and January 31, 2012 afterwards until the hazardous waste residence times had transpired. HTS has specified the OPL and emission limit exceeded, the time period of the exceedance, and the highest values of the exceeded OPLs and emission limits for these events.

HTS does not record instantaneous data. All data logged is logged as one minute averages. Although data is logged as one-minute averages, the OPL for SCC pressure is monitored and controlled instantaneously. Therefore, HTS cannot provide a high/low value for SCC pressure.

Name	Start Time	End Time	Duration(hh:mm:ss)	High/Low Value	Applicable Emission Limit
SCC Pressure	1/16/2011 7:53	1/16/2011 7:54	0:00:43		Fug. Emi.
SCC Pressure	1/16/2011 7:55	1/16/2011 7:55	0:00:32		Fug. Emi.
SCC Pressure	1/16/2011 7:56	1/16/2011 7:56	0:00:03		Fug. Emi.
SCC Pressure	1/16/2011 7:56	1/16/2011 7:56	0:00:10		Fug. Emi.
SCC Pressure	1/16/2011 7:57	1/16/2011 7:57	0:00:17		Fug. Emi.
THC	1/16/2011 7:57	1/16/2011 8:56	0:58:56	14.2	CO/THC
SCC Pressure	1/16/2011 7:57	1/16/2011 7:57	0:00:03		Fug. Emi.
SCC Pressure	1/16/2011 7:58	1/16/2011 7:58	0:00:14		Fug. Emi.
SCC Pressure	1/16/2011 7:58	1/16/2011 7:58	0:00:03		Fug. Emi.

SCC Pressure	1/16/2011 8:01	1/16/2011 8:01	0:00:05		Fug. Emi.
SCC Pressure	1/16/2011 8:01	1/16/2011 8:01	0:00:03		Fug. Emi.
Kiln Temperature	1/16/2011 8:05	1/16/2011 9:08	1:03:00	1586	DRE/Dioxin
SCC Temperature	1/16/2011 8:02	1/16/2011 9:08	1:05:59	1481	DRE/Dioxin
SCC Pressure	6/9/2011 7:30	6/9/2011 7:30	0:00:05		Fug. Emi.
SCC Pressure	6/9/2011 7:30	6/9/2011 7:30	0:00:03		Fug. Emi.
SCC Pressure	1/31/2012 3:04	1/31/2012 3:04	0:00:05		Fug. Emi.
SCC Pressure	1/31/2012 3:04	1/31/2012 3:04	0:00:12		Fug. Emi.
Kiln Temperature	1/31/2012 3:17	1/31/2012 4:38	1:21:01	1103	DRE/Dioxin
SCC Temperature	1/31/2012 3:18	1/31/2012 4:42	1:23:58	1072	DRE/Dioxin

January 16, 2011 Event:

The problematic waste HTS identified as a potential contributor to the January 16, 2011 event was 92195-2. HTS received approximately 8 bulk solid loads of this material between January 2011 and February 2011. See Attachment 23 for container numbers, waste/chemical profile description and packet.

June 9, 2011 Event:

The problematic waste HTS identified as a potential contributor to the June 9, 2011 event was a clarified slurry oil – tank sediment received from generator Philadelphia Energy Solutions, waste profile 96406-12. HTS received approximately 100 bulk solid loads of this material. See Attachment 24 for container numbers, waste/chemical profile description and packet.

January 31, 2012

The problematic waste HTS identified as a potential contributor to the January 31, 2012 event was a tank clean out containing K170 from Paulsboro Refining Company, waste profile 92743-22. HTS received 2 bulk solid loads of this material prior to this event. See Attachment 25 for container numbers, waste/chemical profile description and packet.

For information on waste handling, see the response to Question 1(f), above.

For information on how waste/chemical profiles and profile packets are derived, see Question 1(e).

For information on investigation into each of these events, see the response to Question 1(d), above and Question 8(d)(iv) below.

See Attachment 26 for dates when the waste containers identified in response to this Question 7 were received by the facility.

The dates of incineration for the wastes identified in this Question 7 are listed in Attachment 26. The date of incineration shown on the documents located in Attachment 26 for each of these deliveries is a statistical calculation that documents the date that the waste has been completely removed from the pit. The calculation is based on an even distribution of

material in the pit and an average of all of the wastes that are comingled in the pit. When either the volume or the percentage of any individual load reaches a de minimis level, the inventory tracking system archives the record and shows that the load has been completely incinerated.

See response to Question 1(h) for information on HTS screening process.

See Attachment 27 for testing and analysis for waste profiles 92195-2 and 92743-22. See Attachment 14 for testing and analysis for waste profile 2484-100.

See Attachment 28 for dates when HTS received and processed the same waste identified in response to Question 7 since January 2011.

This response was prepared by Vince Waggle, Steve Lorah, Scott Yocum, Stewart Fletcher, and Ralph Roper.

Question 8: **In its response to EPA's Request for Information, HTS stated: "...aside from the April 2011, March 2013, and July 2013 events discussed in detail in this response, there have been a total of 123 pressure exceedances attributed to clinker falls since 2010." For each of these clinker falls and for any which have occurred since the time you responded to the first Request for Information, provide the following information:**

(a) **List all the dates and times that HTS exceeded OPLs and/or emission limits for the Facility at the time of the above described clinker falls and afterwards until the hazardous waste residence times had transpired. For each day and time of an exceedance, specify: the OPL and emission limit exceeded, the time period of the exceedance, and the highest values of the exceeded OPLs and emission limits**;

The table below identifies the dates and times that HTS exceeded OPLs and/or emission limits for the facility during clinker falls and afterwards until the hazardous waste residence times had transpired. The information below specifies the OPL and emission limit exceeded, the time period of the exceedance, and the highest values of the exceeded OPLs and emission limits.

HTS does not record instantaneous data. All data logged is logged as one minute averages. Although data is logged as one-minute averages, the OPL for SCC pressure is monitored and controlled instantaneously. Therefore, HTS cannot provide a high/low value for SCC pressure.

As requested, HTS has provided all the dates and times that HTS exceeded OPLs and/or emission limits for the Facility at the time of the above described clinker falls and afterwards until the hazardous waste residence times had transpired. The 123 SCC pressure exceedances due to clinker falls that HTS identified in RFI #1 are included in the table below. In addition, the table below includes SCC pressure exceedances that were not attributed to clinker falls. All SCC pressure exceedances are included in the table below. It should be noted that one event can have multiple OPL exceedances, thus some of the 123 clinker falls reported in RFI #1 are referenced more than once in the following table.

Event Name	Start Time	End Time	Duration	High/Low Value	Applicable Emission Limit	Count
SCC Pressure	1/2/2010 17:42	1/2/2010 17:42	0:00:03		Fug. Emi.	4870
SCC Pressure	1/2/2010 17:42	1/2/2010 17:42	0:00:03		Fug. Emi.	4871
SCC Pressure	1/3/2010 10:13	1/3/2010 10:13	0:00:03		Fug. Emi.	4872
SCC Pressure	1/3/2010 10:13	1/3/2010 10:13	0:00:02		Fug. Emi.	4873
SCC Pressure	4/19/2010 9:03	4/19/2010 9:03	0:00:02		Fug. Emi.	4963
SCC Pressure	4/27/2010 17:33	4/27/2010 17:33	0:00:13		Fug. Emi.	4968
SCC Pressure	5/9/2010 13:46	5/9/2010 13:46	0:00:02		Fug. Emi.	5009
SCC Pressure	5/9/2010 13:46	5/9/2010 13:46	0:00:02		Fug. Emi.	5010
SCC Pressure	5/11/2010 2:39	5/11/2010 2:39	0:00:07		Fug. Emi.	5011
SCC Pressure	5/17/2010 15:34	5/17/2010 15:34	0:00:07		Fug. Emi.	5067
SCC Pressure	5/17/2010 15:34	5/17/2010 15:34	0:00:11		Fug. Emi.	5068
SCC Pressure	5/26/2010 6:22	5/26/2010 6:22	0:00:06		Fug. Emi.	5079
SCC Pressure	5/26/2010 6:22	5/26/2010 6:22	0:00:06		Fug. Emi.	5080
SCC Pressure	5/26/2010 8:28	5/26/2010 8:28	0:00:06		Fug. Emi.	5081
SCC Pressure	5/26/2010 8:28	5/26/2010 8:28	0:00:11		Fug. Emi.	5082
SCC Pressure	5/27/2010 12:26	5/27/2010 12:26	0:00:04		Fug. Emi.	5087
SCC Pressure	5/27/2010 12:26	5/27/2010 12:26	0:00:02		Fug. Emi.	5088
SCC Pressure	6/1/2010 5:46	6/1/2010 5:46	0:00:05		Fug. Emi.	5091
SCC Pressure	6/1/2010 5:46	6/1/2010 5:47	0:00:12		Fug. Emi.	5092
SCC Pressure	6/4/2010 21:47	6/4/2010 21:47	0:00:03		Fug. Emi.	5099
SCC Pressure	6/8/2010 23:37	6/8/2010 23:37	0:00:04		Fug. Emi.	5100
SCC Pressure	6/8/2010 23:37	6/8/2010 23:38	0:00:06		Fug. Emi.	5101
SCC Pressure	6/16/2010 2:59	6/16/2010 2:59	0:00:02		Fug. Emi.	5114
SCC Pressure	6/16/2010 2:59	6/16/2010 2:59	0:00:03		Fug. Emi.	5115
SCC Pressure	6/25/2010 21:49	6/25/2010 21:49	0:00:03		Fug. Emi.	5124
SCC Pressure	6/27/2010 13:32	6/27/2010 13:32	0:00:03		Fug. Emi.	5125
SCC Pressure	7/26/2010 14:13	7/26/2010 14:13	0:00:03		Fug. Emi.	5183
SCC Pressure	7/26/2010 14:13	7/26/2010 14:13	0:00:13		Fug. Emi.	5184
SCC Pressure	8/6/2010 21:10	8/6/2010 21:10	0:00:04		Fug. Emi.	5191
SCC Pressure	8/16/2010 7:11	8/16/2010 7:11	0:00:02		Fug. Emi.	5219
SCC Pressure	8/16/2010 7:11	8/16/2010 7:11	0:00:07		Fug. Emi.	5220
SCC Pressure	8/18/2010 7:57	8/18/2010 7:57	0:00:02		Fug. Emi.	5233
SCC Pressure	8/20/2010 4:09	8/20/2010 4:09	0:00:05		Fug. Emi.	5238
SCC Pressure	8/21/2010 7:50	8/21/2010 7:50	0:00:02		Fug. Emi.	5240
SCC Pressure	8/21/2010 15:56	8/21/2010 15:56	0:00:02		Fug. Emi.	5241
SCC Pressure	8/21/2010 15:56	8/21/2010 15:56	0:00:05		Fug. Emi.	5242
SCC Pressure	8/25/2010 21:21	8/25/2010 21:21	0:00:03		Fug. Emi.	5246
SCC Pressure	8/27/2010 7:20	8/27/2010 7:20	0:00:04		Fug. Emi.	5247
SCC Pressure	9/1/2010 10:25	9/1/2010 10:25	0:00:03		Fug. Emi.	5260
SCC Pressure	9/5/2010 2:53	9/5/2010 2:53	0:00:04		Fug. Emi.	5261
SCC Pressure	9/28/2010 16:37	9/28/2010 16:37	0:00:03		Fug. Emi.	5351
SCC Pressure	9/28/2010 16:37	9/28/2010 16:38	0:00:13		Fug. Emi.	5352
THC	9/28/2010 16:42	9/28/2010 17:41	0:59:02	12.7	CO/THC	5353
SCC Pressure	9/30/2010 23:35	9/30/2010 23:35	0:00:03		Fug. Emi.	5356

SCC Pressure	11/11/2010 14:53	11/11/2010 14:53	0:00:04		Fug. Emi.	5408
SCC Pressure	11/11/2010 14:54	11/11/2010 14:54	0:00:06		Fug. Emi.	5409
SCC Pressure	11/12/2010 12:25	11/12/2010 12:25	0:00:03		Fug. Emi.	5411
SCC Pressure	12/12/2010 12:06	12/12/2010 12:06	0:00:03		Fug. Emi.	5441
SCC Pressure	1/4/2011 5:37	1/4/2011 5:37	0:00:06		Fug. Emi.	5466
THC	1/4/2011 5:40	1/4/2011 6:40	0:59:59	19.2	CO/THC	5467
SCC Pressure	1/4/2011 6:45	1/4/2011 6:45	0:00:03		Fug. Emi.	5468
SCC Pressure	1/4/2011 6:45	1/4/2011 6:45	0:00:07		Fug. Emi.	5469
SCC Pressure	1/10/2011 0:12	1/10/2011 0:12	0:00:08		Fug. Emi.	5482
SCC Pressure	1/11/2011 5:22	1/11/2011 5:22	0:00:03		Fug. Emi.	5484
SCC Pressure	1/16/2011 7:53	1/16/2011 7:54	0:00:43		Fug. Emi.	5486
SCC Pressure	1/16/2011 7:55	1/16/2011 7:55	0:00:32		Fug. Emi.	5488
SCC Pressure	1/16/2011 7:56	1/16/2011 7:56	0:00:03		Fug. Emi.	5489
SCC Pressure	1/16/2011 7:56	1/16/2011 7:56	0:00:10		Fug. Emi.	5490
SCC Pressure	1/16/2011 7:57	1/16/2011 7:57	0:00:17		Fug. Emi.	5491
THC	1/16/2011 7:57	1/16/2011 8:56	0:58:56	14.2	CO/THC	5492
SCC Pressure	1/16/2011 7:57	1/16/2011 7:57	0:00:03		Fug. Emi.	5493
SCC Pressure	1/16/2011 7:58	1/16/2011 7:58	0:00:14		Fug. Emi.	5494
SCC Pressure	1/16/2011 7:58	1/16/2011 7:58	0:00:03		Fug. Emi.	5495
SCC Pressure	1/16/2011 8:01	1/16/2011 8:01	0:00:05		Fug. Emi.	5496
SCC Pressure	1/16/2011 8:01	1/16/2011 8:01	0:00:03		Fug. Emi.	5497
Kiln Temperature	1/16/2011 8:05	1/16/2011 9:08	1:03:00	1586	DRE/Dioxin	5498
SCC Temperature	1/16/2011 8:02	1/16/2011 9:08	1:05:59	1481	DRE/Dioxin	5499
SCC Pressure	1/17/2011 4:22	1/17/2011 4:22	0:00:07		Fug. Emi.	5502
SCC Pressure	1/17/2011 4:23	1/17/2011 4:23	0:00:07		Fug. Emi.	5503
SCC Pressure	1/17/2011 4:25	1/17/2011 4:25	0:00:08		Fug. Emi.	5505
SCC Pressure	1/17/2011 4:26	1/17/2011 4:26	0:00:03		Fug. Emi.	5506
THC	1/17/2011 4:26	1/17/2011 5:33	1:06:59	46.2	CO/THC	5507
SCC Pressure	1/17/2011 4:27	1/17/2011 4:28	0:01:06		Fug. Emi.	5508
SCC Pressure	1/18/2011 16:37	1/18/2011 16:37	0:00:03		Fug. Emi.	5509
SCC Pressure	1/18/2011 16:37	1/18/2011 16:38	0:00:06		Fug. Emi.	5510
SCC Pressure	1/31/2011 11:00	1/31/2011 11:00	0:00:07		Fug. Emi.	5524
SCC Pressure	1/31/2011 11:00	1/31/2011 11:00	0:00:14		Fug. Emi.	5525
THC	1/31/2011 11:08	1/31/2011 12:07	0:59:00	17.8	CO/THC	5526
SCC Pressure	2/6/2011 4:15	2/6/2011 4:15	0:00:06		Fug. Emi.	5540
SCC Pressure	3/26/2011 22:16	3/26/2011 22:16	0:00:06		Fug. Emi.	5607
SCC Pressure	3/26/2011 22:16	3/26/2011 22:16	0:00:11		Fug. Emi.	5608
SCC Pressure	3/27/2011 0:56	3/27/2011 0:56	0:00:03		Fug. Emi.	5614
SCC Pressure	3/27/2011 0:56	3/27/2011 0:56	0:00:06		Fug. Emi.	5615
SCC Pressure	3/29/2011 8:20	3/29/2011 8:20	0:00:04		Fug. Emi.	5616
SCC Pressure	3/29/2011 8:20	3/29/2011 8:20	0:00:04		Fug. Emi.	5617
SCC Pressure	3/30/2011 10:35	3/30/2011 10:35	0:00:03		Fug. Emi.	5619
SCC Pressure	3/30/2011 12:10	3/30/2011 12:10	0:00:03		Fug. Emi.	5620
SCC Pressure	3/30/2011 21:24	3/30/2011 21:24	0:00:03		Fug. Emi.	5621
SCC Pressure	3/30/2011 21:24	3/30/2011 21:24	0:00:04		Fug. Emi.	5622

SCC Pressure	3/31/2011 2:42	3/31/2011 2:42	0:00:06		Fug. Emi.	5623
SCC Pressure	4/1/2011 20:56	4/1/2011 20:56	0:00:03		Fug. Emi.	5630
SCC Pressure	4/4/2011 19:19	4/4/2011 19:19	0:00:02		Fug. Emi.	5634
SCC Pressure	4/4/2011 19:19	4/4/2011 19:20	0:00:05		Fug. Emi.	5635
SCC Pressure	4/4/2011 22:03	4/4/2011 22:03	0:00:07		Fug. Emi.	5636
SCC Pressure	4/4/2011 22:03	4/4/2011 22:03	0:00:13		Fug. Emi.	5637
SCC Pressure	4/4/2011 23:34	4/4/2011 23:34	0:00:03		Fug. Emi.	5639
SCC Pressure	4/4/2011 23:34	4/4/2011 23:34	0:00:08		Fug. Emi.	5640
SCC Pressure	4/6/2011 5:57	4/6/2011 5:57	0:00:03		Fug. Emi.	5643
SCC Pressure	4/6/2011 5:57	4/6/2011 5:57	0:00:07		Fug. Emi.	5644
SCC Pressure	4/12/2011 22:40	4/12/2011 22:40	0:00:04		Fug. Emi.	5656
SCC Pressure	4/12/2011 22:40	4/12/2011 22:41	0:01:01		Fug. Emi.	5657
SCC Pressure	4/12/2011 22:41	4/12/2011 22:42	0:00:26		Fug. Emi.	5659
THC	4/12/2011 22:43	4/12/2011 23:43	1:00:00	19	CO/THC	5660
SCC Temperature	4/12/2011 22:56	4/13/2011 6:59	8:03:43	729.9	DRE/Dioxin	5661
Kiln Temperature	4/12/2011 22:59	4/13/2011 6:59	8:00:43	725.5	DRE/Dioxin	5662
SDA ECIS Pressure	4/12/2011 23:22	4/13/2011 6:59	7:38:50	0	Dioxin/Hg	5663
Process Gas Flow	4/12/2011 23:32	4/13/2011 0:17	0:45:58	70728	DRE/Dioxin/SVM/LVM/HCL/PM	5664
RJ Blowdown Flow	4/13/2011 0:30	4/13/2011 2:19	1:49:00	0	Hg/Dioxin/SVM/LVM/HCL/PM	5665
Scrubber ECIS Pressure	4/13/2011 3:04	4/13/2011 6:59	3:58:06	0	Dioxin/Hg	5666
SCC Pressure	5/4/2011 17:29	5/4/2011 17:29	0:00:06		Fug. Emi.	5673
SCC Pressure	5/5/2011 4:48	5/5/2011 4:48	0:00:02		Fug. Emi.	5674
SCC Pressure	5/5/2011 4:48	5/5/2011 4:48	0:00:05		Fug. Emi.	5675
SCC Pressure	5/10/2011 23:44	5/10/2011 23:44	0:00:06		Fug. Emi.	5686
SCC Pressure	5/10/2011 23:44	5/10/2011 23:44	0:00:12		Fug. Emi.	5687
SCC Pressure	5/10/2011 23:46	5/10/2011 23:47	0:01:02		Fug. Emi.	5689
THC	5/10/2011 23:49	5/11/2011 0:48	0:59:00	12.6	CO/THC	5690
SDA ECIS Pressure	5/11/2011 0:16	5/11/2011 1:51	1:35:59	0	Dioxin/Hg	5691
Scrubber ECIS Pressure	5/11/2011 0:20	5/11/2011 1:51	1:31:57	0	Dioxin/Hg	5692
SCC Pressure	5/11/2011 7:50	5/11/2011 7:50	0:00:21		Fug. Emi.	5693
SCC Pressure	6/7/2011 21:33	6/7/2011 21:33	0:00:03		Fug. Emi.	5724
SCC Pressure	6/7/2011 21:34	6/7/2011 21:34	0:00:03		Fug. Emi.	5725
SCC Pressure	6/9/2011 7:30	6/9/2011 7:30	0:00:05		Fug. Emi.	5726
SCC Pressure	6/9/2011 7:30	6/9/2011 7:30	0:00:03		Fug. Emi.	5727
SCC Pressure	6/26/2011 3:35	6/26/2011 3:35	0:00:02		Fug. Emi.	5746
SCC Pressure	6/26/2011 3:35	6/26/2011 3:35	0:00:03		Fug. Emi.	5747
SCC Pressure	10/14/2011 13:03	10/14/2011 13:03	0:00:03		Fug. Emi.	5862
SCC Pressure	11/5/2011 10:32	11/5/2011 10:32	0:00:09		Fug. Emi.	5875
SCC Pressure	11/6/2011 0:02	11/6/2011 0:02	0:00:04		Fug. Emi.	5877
SCC Pressure	11/28/2011 10:57	11/28/2011 10:57	0:00:03		Fug. Emi.	5891
SCC Pressure	12/1/2011 15:05	12/1/2011 15:05	0:00:02		Fug. Emi.	5892
SCC Pressure	12/1/2011 15:05	12/1/2011 15:05	0:00:04		Fug. Emi.	5893
THC	12/1/2011 15:09	12/1/2011 15:39	0:30:01	11.7	CO/THC	5894
SCC Pressure	12/17/2011 0:05	12/17/2011 0:05	0:00:05		Fug. Emi.	5903
SCC Pressure	12/17/2011 0:05	12/17/2011 0:05	0:00:12		Fug. Emi.	5904

SCC Pressure	12/27/2011 10:11	12/27/2011 10:11	0:00:04		Fug. Emi.	5907
SCC Pressure	12/27/2011 10:11	12/27/2011 10:11	0:00:07		Fug. Emi.	5908
SCC Pressure	1/31/2012 3:04	1/31/2012 3:04	0:00:05		Fug. Emi.	5922
SCC Pressure	1/31/2012 3:04	1/31/2012 3:04	0:00:12		Fug. Emi.	5923
Kiln Temperature	1/31/2012 3:17	1/31/2012 4:38	1:21:01	1103	DRE/Dioxin	5924
SCC Temperature	1/31/2012 3:18	1/31/2012 4:42	1:23:58	1072	DRE/Dioxin	5925
SCC Pressure	3/5/2012 10:25	3/5/2012 10:25	0:00:02		Fug. Emi.	5945
SCC Pressure	3/5/2012 10:26	3/5/2012 10:26	0:00:02		Fug. Emi.	5946
SCC Pressure	9/18/2012 9:00	9/18/2012 9:00	0:00:30		Fug. Emi.	6111
SCC Pressure	9/22/2012 20:08	9/22/2012 20:09	0:00:30		Fug. Emi.	6114
SCC Pressure	11/4/2012 5:35	11/4/2012 5:36	0:00:35		Fug. Emi.	6161
SCC Pressure	12/7/2012 11:04	12/7/2012 11:04	0:00:29		Fug. Emi.	6180
THC	12/7/2012 11:08	12/7/2012 12:07	0:58:53	15.2	CO/THC	6182
SCC Pressure	12/19/2012 2:33	12/19/2012 2:34	0:00:30		Fug. Emi.	6183
THC	12/19/2012 2:44	12/19/2012 3:36	0:52:12	11.6	CO/THC	6184
SCC Pressure	1/20/2013 13:47	1/20/2013 13:48	0:00:35		Fug. Emi.	6193
SCC Pressure	3/3/2013 5:44	3/3/2013 5:45	0:00:36		Fug. Emi.	6208
SCC Pressure	4/9/2013 3:14	4/9/2013 3:15	0:00:30		Fug. Emi.	6222
SCC Pressure	4/28/2013 9:17	4/28/2013 9:18	0:00:30		Fug. Emi.	6235
SCC Pressure	4/30/2013 16:49	4/30/2013 16:50	0:00:17		Fug. Emi.	6238
SCC Pressure	7/13/2013 12:59	7/13/2013 13:00	0:01:03		Fug. Emi.	6296
SCC Pressure	10/30/2013 12:56	10/30/2013 12:56	0:00:30		Fug. Emi.	6748

This response was prepared by Vince Waggle, Kevin Lloyd, and Carrie Beringer.

(b) Submit copies of HTS's operating parameter and emission monitoring data for the period November 1, 2010 through the present. The monitoring data should include: (i) all 1-hour and 12-hour rolling average data, as applicable to the particular OPL or emission limit being measured; and (ii) all instantaneous and/or one minute readings of secondary combustion chamber pressure, pressure in the inlet and outlet shrouds, and feed lance atomization pressure. HTS may submit the monitoring data on a compact disk or thumb drive in comma separated value or Plain Text format.

See Attachment 29 for the response to Question 8(b).

This response was prepared by Gary Jones.

(c) Identify any times since January 1, 2010 that the automatic waste feed cutoff system did not immediately and automatically cut off the hazardous waste feed during a clinker fall event that resulted in an OPL or emissions exceedance. If such incidences did occur, explain why.

There have been no times since January 1, 2010 that the automatic waste feed system has failed to halt waste feeds to the incinerator during a clinker fall event. In a letter from US EPA to Von Roll America, Inc. (now HTS) dated 9/4/2003, EPA approved an alternative

monitoring request that specified how the facility would measure combustion zone pressure and prevent combustion system leaks. *See* Attachment 30 for the 9/4/2003 letter. This approved method includes a requirement for engaging the automatic waste feed cutoff system when certain conditions are met. In each instance of a clinker fall event since January 1, 2010, the procedures identified in the 9/4/2003 letter have been followed. As required by regulation, HTS conducts a weekly test of the automatic waste feed cutoff system to verify it operability.

This response was prepared by Vince Waggle.

(d) For each of the clinker fall events that have occurred since 2010 and that resulted in an OPL or emissions exceedance, answer the following:

(i) **Identify whether you claim that the exceedance was caused by a malfunction, as that term is defined by 40 C.F.R. § 63.2**;

The OPL exceedances identified in response to Question 8 were the result of clinker fall malfunctions as defined in the facility's Startup, Shutdown, and Malfunction Plan. This Startup, Shutdown, and Malfunction Plan describes the circumstances that result in a clinker fall and how these events meet the definition of a malfunction as described in 40 C.F.R 63.2. *See also* HTS' Response to RFI 1.

This response was prepared by Vince Waggle.

(ii) **Explain how the claimed malfunction fits the definition of malfunction at 40 C.F.R. § 63.2;**

As described in HTS Startup, Shutdown, and Malfunction Plan, which it submitted to the Ohio Environmental Protection Agency ("OEPA"), a clinker occurs because:

> Flue gas exiting the rotary kiln most often contains small particles of ash. These particles have the potential to accumulate on the sidewalls and ceiling of the Secondary Combustion Chamber (SCC). After a while, the weight of this build-up causes the ash to fall. At the base of the SCC is a water-filled tank used to quench slag falling out of the kiln. When these large masses of hot ash fall from the walls of the SCC and strike the water, a rapid expansion of steam may occur. This steam expansion has the potential to cause immediate pressure increases within the incineration system for which the operator is unable to compensate. These events can lead to failure to maintain MACT parameters for SCC Pressure and possibly THC.
>
> [HTS] does not have the ability to regulate ash build-up on the SCC walls nor anticipate when the material will fall. As a result, when this occurs and leads to an exeedance of a MACT parameter, [HTS] will classify the event as a process malfunction.

See response to Question 9 of RFI 1; SSMP Revision 11, July 2012.

This response was prepared by Vince Waggle.

(iii) **Identify the malfunction that you claim caused the exceedance;**

The OPL exceedances identified in response to Question 8 were all determined to be the result of clinker falls as defined in the facility's Startup, Shutdown, and Malfunction Plan. This Startup, Shutdown, and Malfunction Plan describes the circumstances that result in a clinker fall and how these events meet the definition of a malfunction as described in 40 C.F.R 63.2.

This response was prepared by Vince Waggle.

(iv) **Explain your investigation into the cause of each exceedance; the corrective actions taken to correct the exceedance; and the evaluation of approaches to minimize the frequency, duration, and severity of the exceedance. Provide copies of documents discussing the investigation of the cause of the exceedance; the corrective actions taken to correct the exceedance; and the evaluation of approaches to minimize the frequency, duration, and severity of the exceedance;**

All of the events described in EPA Question 8 were reviewed by a committee made up of HTS staff members from the Environmental, Health, and Safety Department, Incinerator Operations Group, Production Management Group, and the Balance of Plant Group. The committee members used their knowledge of regulatory requirements, waste management techniques, chemical processing experience, and incinerator operation to assess each event individually and as a whole to determine an immediate and root cause as well as an appropriate corrective action. This committee utilizes process data, waste feed information, employee feedback, and surveillance evidence to make this determination.

The results of each of these investigations is shown in the excel spreadsheet located in Attachment 31.

This response was prepared by Vince Waggle.

(v) Provide copies of any engineering evaluations that HTS has had done to try to minimize clinker falls or clinker accumulations; and

HTS has looked at several monitoring technologies in an effort to "see" when there was ash build up in the SCC. Each of the monitoring technologies had its own limitations that made the technology unsuitable for HTS' application.

Enhanced Infrared Camera Systems: This system was impractical for HTS' application due to the following:

1) Requires a direct line of sight which is not available.
2) Viewing clearly through the flame is dependent on the quality of the flame. HTS cannot control the quality of the flame.
3) This technology cannot distinguish between typical slag/ash buildup verses the buildup of problematic ash/slag.

Laser and LIDAR Scanning Technologies: This system was impractical for HTS' application due to the following:

1) Requires the addition of monitoring ports.
2) This technology is not suited for the high temperatures experienced in the SCC.

In addition to monitoring technologies, HTS researched a technology to remove solids from the SCC. Again, HTS discovered that the solids removal technology was unsuitable for HTS' application.

Soot Blowers: This system was impractical for HTS' application due to the following:

1) After speaking with soot blower manufacturers, soot blowers are not effective for the removal of slag build up.
2) Soot blowers may affect the OPL for SCC pressure.

See Attachment 32 for Leidos Engineering Research Summary. For additional information on technologies evaluated, see the response to Question 6(g), above.

This response was prepared by Kevin Lloyd, Bob Buchheit, and Stewart Fletcher.

(vi) State whether HTS ever investigated or received estimates related to re-engineering of the gas flow path in order to prevent clinker accumulations. If so, provide copies of the estimates.

In 2007, HTS hired a consultant to characterize the combustion characteristics within the incinerator and identify potential modifications that would allow an increase in waste processing while reducing the number of combustion related emission excursions. The results of that study are detailed in report Jansen Project No. 2007-0016 report, dated November 2007. See Attachment 33. The Jansen Project No. 2007-0016 report is Confidential Business Information (CBI). As a result, HTS is claiming CBI protections for this report. Each page of the report is marked "Confidential."

This response was prepared by Carrie Beringer.

Question 9: Provide copies of all Semi-Annual Startup, Shutdown and Malfunction Reports and Semi-Annual Excess Emissions Reports (required by 40 C.F.R. § 63.10) that pertain to the period January 1, 2012 through December 31, 2013. Provide copies of all MACT Excessive Exceedance Reports (required by 40 C.F.R. § 63.1206(c)(3)(vi)) that pertain to the period January 1, 2010 through the present.

See Attachments 34 for Semi-Annual Startup, Shutdown and Malfunction Reports and Semi-Annual Excess Emissions Reports and Attachment 35 for MACT Excessive Exceedance Reports.

This response was prepared by Vince Waggle.

Question 10 Provide copies of all reports submitted to Ohio EPA pursuant to 40 C.F.R. § 63.1206(c)(2)(v)(A)(3) (excessive exceedances during malfunctions). If no such reports have been submitted to Ohio EPA, please explain why.

The information requested by Question 10 is incorporated into the reports provided in response to Question 9. *See* Attachments 34 and 35. Heritage Thermal Services reviews each malfunction event separately and in relation to malfunction events that occur within the surrounding 60-day period as required by 40 C.F.R 63.1206(c)(2)(v)(A)(3). The reports provided in Question 9 contain summaries of each event and the actions that were taken to minimize the events.

This response was prepared by Vince Waggle.